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Restoration by Clement B. Davis.

BATTLE BETWEEN TWO DINOSAURS

MIGHTY ANIMALS

BEING SHORT TALKS ABOUT SOME OF THE ANIMALS WHICH LIVED ON THIS EARTH BEFORE MAN APPEARED

BY

JENNIE IRENE MIX

WITH AN INTRODUCTION BY

DR. FREDERIC A. LUCAS

DIRECTOR OF THE AMERICAN MUSEUM OF NATURAL HISTORY

UNIV. OF CALIFORNIA

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MIGHTY ANIMALS.

W. P. I

M. N. W.

THE aim of this book is to interest young people in the life that was lived on this earth before man appeared.

Of the many wonderful animals which lived during that period in the earth's history only some of the most striking among the gigantic types are discussed. For information to be found in books regarding these animals, the author has relied chiefly on two works by Frederic A. Lucas, "Animals of the Past" and "Animals before Man in North America: Their Lives and their Times"; "Extinct Animals" by Sir Edwin Ray Lankester; "Age of Mammals in Europe, Asia, and North America," by Henry Fairfield Osborn; "Extinct Monsters," by Henry Neville Hutchinson; and "The Mammoth and the Flood," by Sir Henry H.

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Howorth. Acknowledgment of valuable assistance is also due the Carnegie Library of Pittsburgh.

But the author's deepest obligation is to Dr. Frederic A. Lucas, Director of the American Museum of Natural History, for the generous interest manifested by him during the preparation of the manuscript and its final editing for scientific accuracy. Without this coöperation on the part of Dr. Lucas the author would not have ventured to present this volume to the public.

PITTSBURGH, PENNSYLVANIA.

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INTRODUCTION

BY

DR. FREDERIC A. LUCAS

Director of American Museum of Natural History

NOT so very long ago a Dinosaur was regarded as a terrible reptile, indeed, whose very name was sufficient to deter us from wishing further acquaintance with him.

Now the name is as familiar in our mouths as household words; the discovery of a Dinosaur is announced by the daily press as a matter of news, and the Sunday edition depicts him at full length. Sometimes, it is true, the portrait is least recognizable by those best acquainted with him, but it shows the public interest in these creatures of a far distant day and a general desire to know something about their lives and times.

Ancient history is largely a record of the deeds of certain mighty men whose achievements have made them prominent among all their fellows, and it is fitting that something should be said of the mighty animals that peopled the earth long before man made his appearance.

The following chapters may be looked upon as a series of biographical sketches of some of the most prominent inhabitants, the very early settlers, so to speak, of this and other lands, the story of their lives and deeds as recorded by nature in the stony leaves of the book of the past and translated by man with much difficulty and labor. These translations are very incomplete because many pages from this book of the past have been destroyed by Nature herself, and many others we shall never be able to recover, so deeply are they buried in the rocks. But it is a very interesting history, "for there were giants in those days of old" and Miss Mix tells us how they swam through the seas, splashed through the marshes, and tramped over the hills of the ancient world. More than this, Miss Mix shows us how they looked, these

strange beasts that lived in a time when there was no human being to look at them.

It is a pity to spoil a story, or a book, by drawing a moral, yet there is one point that I cannot help making. How often, when looking at the skeleton of one of these huge monsters, has some one remarked, "What a pity that these creatures could not have lived until now, so that we might see them in the flesh!" True, it would be interesting! Now there is much danger that our very great grandchildren, passing through the museums of to-morrow, will often remark, "What a pity that all these animals should have been exterminated by our ancestors!"

Let us therefore try to save a few animals in some sanctuary so that our descendants may know about the creatures of to-day, for then there may be no Miss Mix to tell about them.

THE MIGHTY DINOSAURS

(14) LIMB OF DINOSAUR IN POSITION

(Field Photograph, American Museum of Natural History)

THE MIGHTY DINOSAURS

THERE was a time when the whole world was ruled by mighty animals many of which were of gigantic size and quite unlike the animals of to-day. For thousands of centuries they were the monarchs of the land, the water, and the air, and nearly all of them died long before any human being had lived.

But, although the most wonderful among these animals disappeared millions of years before there were any people in the world, we know how some of them looked, where they made their homes, what they ate, and, in some cases, how they died. It is because their bones have been found that so much is known about them. These bones are all buried in rocks, and there are men who spend their time searching for these rocks that they may dig out the bones and study them. In this way much has been learned concerning these creatures which once were the rulers of the world. And among

them none were more powerful than the Dinosaurs, for they were the largest of all animals that have ever walked the earth. Even their name sounds terrifying, for Dinosaur means Terrible Lizard.

These monsters were scattered over the world, but the United States, especially the western portion, seems to have been their headquarters. Immense quantities of their bones have been found in Wyoming and Montana, and many others have been unearthed in Colorado. We know that these creatures also roamed over other parts of our country, and in some places even the marks of their footprints are to be seen in the rocks. By comparing all the Dinosaur bones and footprints discovered in the world men have been able to learn how different from one another many of these animals were in their looks and habits.

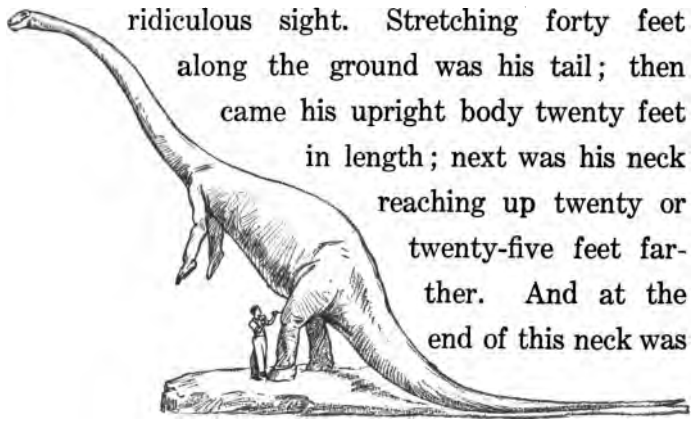
That some were flesh eaters and that others ate only plants, is shown by the formation of their teeth. There were big ones that were weak and small ones that were strong. Certain kinds walked on all fours, while the front legs of others

were so short they could walk only on their hind legs, like the kangaroo. Some were reptile-footed; others had feet like birds. But the men who have made a study of their bones have classed them all with the reptiles although they looked no more like the reptiles of to-day than an elephant looks like a canary bird.

Wonderful, indeed, must the world have appeared when the Dinosaurs were alive! Some of them were sixteen feet high and eighty feet long. Although these huge ones walked on all fours, they occasionally raised themselves up on hind legs and tail, and when in this position their heads must have been fully forty-five feet above the ground. Did a plant-eater see some sweet, tender leaves at the top of a big tree? Then, if he was hungry, all he had to do was to sit up on his hind legs, rear his head, and pluck off the toothsome bit. Or did he suspect that an enemy was approaching? Instead of depending on ears and smell alone to detect the foe while still at a distance, he could rear up and take a look at the surrounding country. Had there been any houses in

those days, he could have looked right over the top of a good-sized three-story building.

When the Dinosaur called Diplodocus reared up in this fashion he must have presented a most ridiculous sight. Stretching forty feet along the ground was his tail; then came his upright body twenty feet in length; next was his neck reaching up twenty or twenty-five feet farther. And at the end of this neck was



MODEL OF DIPLODOCUS AND MAN TO SHOW COMPARATIVE SIZE

a head no bigger than that of a small horse. As for his mouth, well, it is impossible to imagine enough food being taken in through it to satisfy the appetite of a creature which weighed nearly twenty tons.

But perhaps Diplodocus did not have a large appetite. Being a reptile, he may have been cold-blooded and, like all reptiles now living, able to get along without food for days at a time. His weak

and slender teeth, among which were no grinders, were adapted only to soft food, and he undoubtedly lived on the juicy plants that were then so abundant. For in those days the western portion of North America, where Diplodocus made his home, was not a mountainous country. Instead, it was level and made up largely of swampy ground, lakes, and slowly flowing streams. The climate and vegetation were tropical, and this was the case in all the other sections of the world where the Dinosaurs lived.

Although Diplodocus was such an enormous creature, he had a brain that was not much bigger than a walnut. So he must have been as stupid as he was awkward. All the Dinosaurs, for that matter, seem to have been sadly lacking in intelligence. The name Morosaurus (Stupid Lizard) has been given to one species. Another species, called Brontosaurus, although of tremendous size, was provided with but a tiny brain. The man who named this creature Thunder Lizard, for that is what Brontosaurus means, must have been thinking of the sound which the animal made when he walked,

(20) *Restoration by Charles Knight*

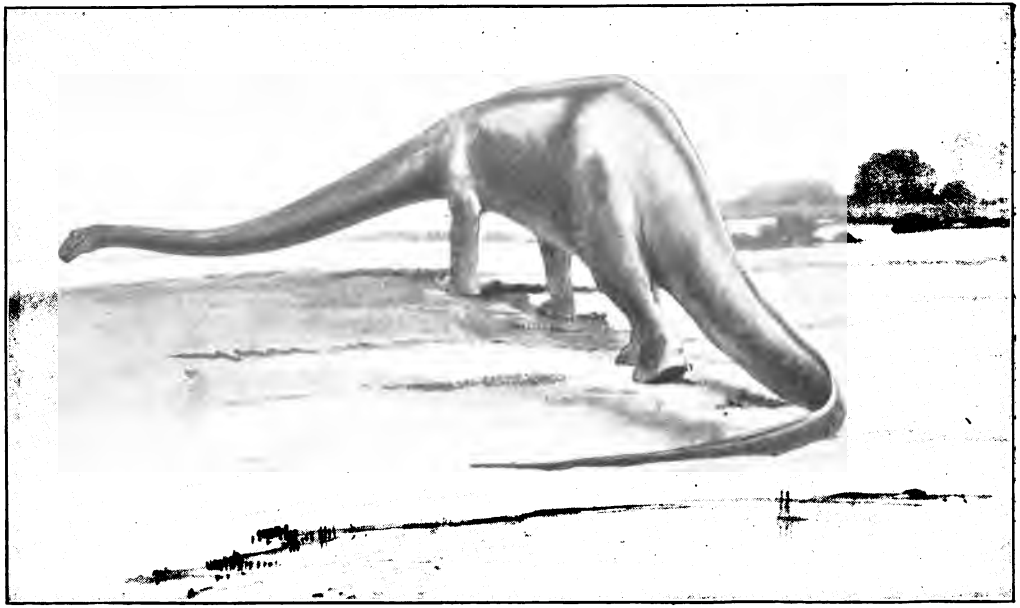
BRONTOSAURS

(After H. F. Osborn. Original in American Museum of Natural History)

and not of his voice. For no one has any idea what sort of voices were possessed by the animals which lived before man. If they were in proportion to their size, it is fortunate there were no human beings living then to hear the fearful din. When large numbers of Dinosaurs were together what deafening sounds must have rent the air.

Although these creatures were so very stupid and were always at war with one another, many of them lived to be very old. Just how old no one pretends to say, but some men have expressed the opinion that the largest lived for hundreds of years and kept on growing all the time. For, as all reptiles grow as long as they live, and as the Dinosaurs belonged in the reptilian class, there is every reason for believing that each additional year of one's age meant an increase in its size.

Probably all of these animals could swim and lived, for at least part of the time, in the water. To have seen the gigantic ones traveling back and forth through the streams, stretching their long necks upward and eagerly scanning the shores for friends or enemies, would have been better sport



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Restoration by Charles Knight

DIPLODOCUS

(After H. F. Osborn. Original in American Museum of Natural History)

than viewing the biggest circus procession that ever paraded for the benefit of the public.

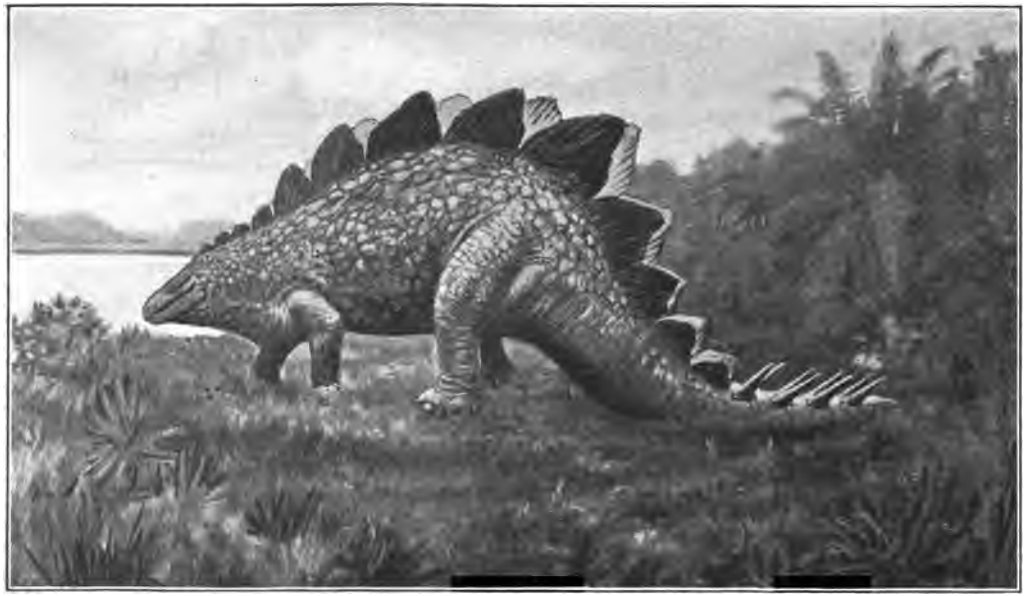
Many of them could wade in deep bodies of water and still keep their heads above the surface. It is thought that as they traveled in this fashion they stopped now and then to browse on the vegetation that grew beneath the water. A Dinosaur, having satisfied his appetite in this way in water twenty or thirty feet deep, could lift his head above the surface to get a breath of fresh air without taking his feet off the bottom. And when he left the water and lay down on the bank in the shade of the palms and tall ferns to take a nap, he occupied a good deal of ground space even if he curled up his tail and doubled up his neck. But if he stretched himself out at full length, the tip of his nose was some eighty feet away from the tip of his tail.

Just what sort of skin most of the Dinosaurs had is not known. That of Diplodocus is believed to have been thick and leathery. Two skeletons of another species have been found with a covering which shows that the skin remained over the

bones after all the other soft parts of the body had been destroyed. These skins indicate that the two Dinosaurs when living were covered with small, horny scales like those seen on the lizards of to-day.

Fierce battles were fought by these animals during the thousands of years they were the kings and queens of the earth. They not only had enemies among other animals, but they attacked one another with intense ferocity. In these battles the flesh eaters stood the best chance of winning; for, while they were smaller than many of the plant eaters they were much stronger. All of these flesh-eating Dinosaurs walked on their hind legs, which in some species like the vicious Allosaurus were seven feet long. They could leap and run with great rapidity and after they had once caught their prey, it seldom escaped them. They held this prey in their grasp with their powerful hind legs while they tore it to pieces with their teeth.

But some of the plant eaters were so hideous that no flesh-eating Dinosaur, however strong, need have apologized to himself for being frightened when he met one of them. There was Stegosaurus, for in-



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Restoration by Charles Knight

STEGOSAURUS

(After F. A. Lucas. Original in American Museum of Natural History)

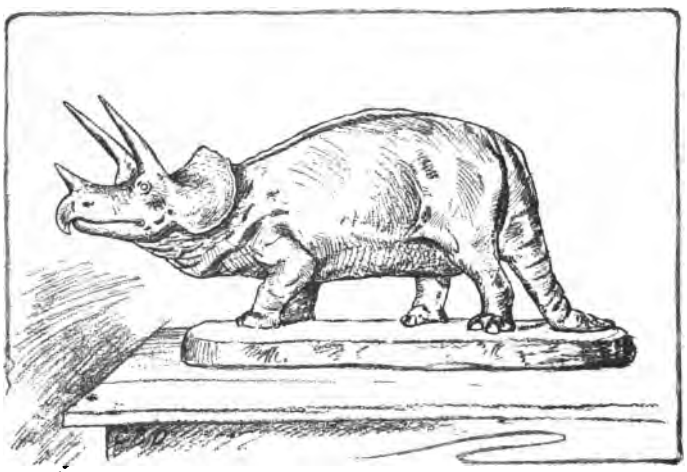
stance. He looked far worse than his name sounds, and that is saying a great deal against his appearance. He had a small head and no neck to speak of; his front legs were so short that his nose almost touched the ground, yet his hind legs were twice as tall as a well-grown man. Then he had spikes on his tail, and hard lumps all over his body, down the center of which were bony crests two feet long and sticking up two feet high, and —

But why tell more? Is not this description sufficient to prove that Stegosaurus, or, to use his English name, Plated Lizard, was ugly enough to justify even the strongest flesh-eating Dinosaur in running away when he saw him coming?

And then again, there was Triceratops, the Dinosaur with the three-horned face, for that is what the name means. These horns grew, one over each eye and one on the end of the nose. Around his neck this creature had a wide, tough frill that gave him an astonishing appearance. Hard knobs were thickly scattered over his back and tail, and, taken altogether, Triceratops rivaled Stegosaurus in ugliness while he was a more dangerous foe for an enemy to

attack. The use he could make of his horns must have worked horrible results, while the frill around his neck and the hard knobs on his body served him as an armor.

But if his enemy happened to be an animal with even a fair-sized brain, then Triceratops found it hard



TRICERATOPS

(Drawing from a Model by Charles Knight)

work to hold his own in a fight, for brains are generally quite as necessary in animals as in human beings. Although this animal with the three-horned face was often twenty-five feet long, ten and one half feet

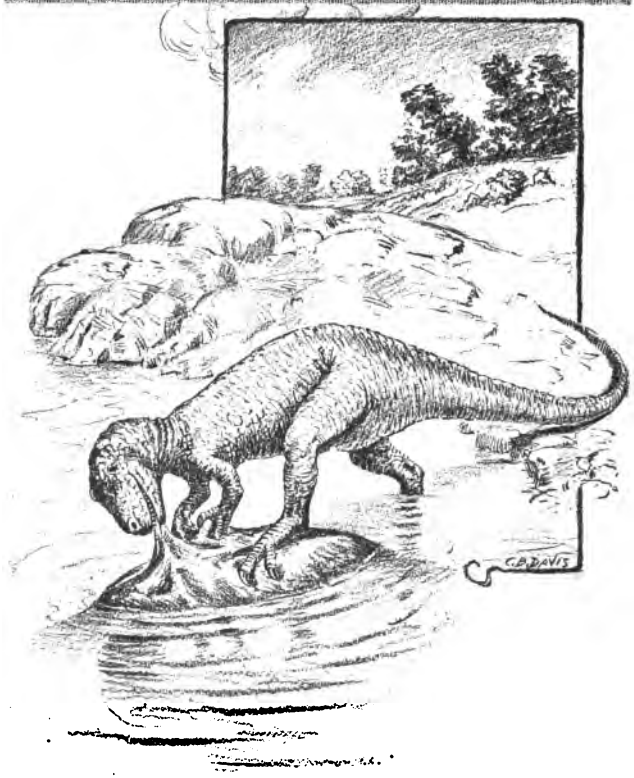
high, and weighed as much as ten tons, his brain seldom weighed more than two pounds! So he was a slow-witted creature although he did look so fierce.

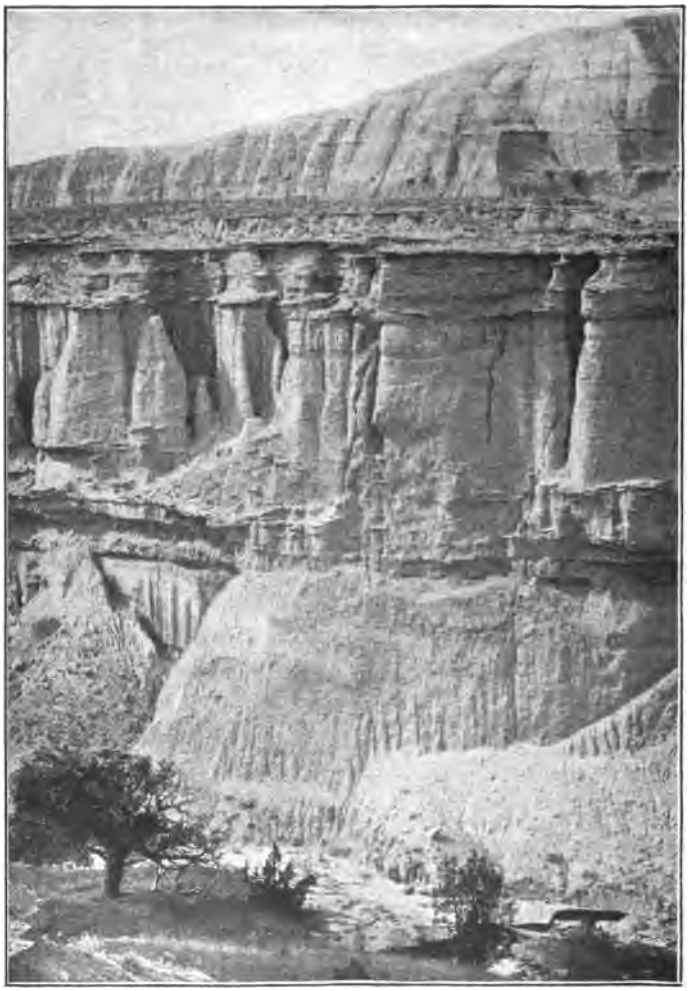
There was little hope for Triceratops or any other animal of his time when attacked by Tyrannosaurus — the Tyrant Lizard — for, among all the flesh-eating Dinosaurs so far discovered, he was the largest and most vicious. There is no flesh-eating animal living to-day nearly as dangerous as was this fearful beast. He was forty feet in length, with a huge skull, jaws four feet long, and teeth that often projected six inches from the socket. Triceratops was no match for such a creature as this. The very sight of his fossilized skull when it is seen in a museum inspires terror. What, then, must Tyrannosaurus have been when alive!

For a million years or more the Dinosaurs lorded it over all the other land animals living on the earth. We shall never know just how many species there were among them, but enough have been discovered to tell us that they varied in size from creatures no larger than a chicken to gigantic forms. Strange does it seem that, although all of them disappeared

millions of years before any human being lived, we should know so much about them to-day. But the human mind can read with remarkable clearness the history of the earth as it is recorded in the rocks. And the Dinosaur bones found buried in many of these rocks furnish some of the most interesting chapters in this history.

How a Dinosaur Was Buried in the Rock





(32) REGION OF ROCK FORMED BENEATH WATER

(Field Photograph, American Museum of Natural History)

HOW A DINOSAUR WAS BURIED IN THE ROCK

IN the days when the Dinosaurs were at the height of their power, a Brontosaurus, as he pulled himself from out the water to lie down on the shore for a rest, was attacked by a hungry Allosaurus. The agile flesh eater sprang on the back of the clumsy Brontosaurus and instantly the two were engaged in a terrific battle. For a while they fought on the soft ground at the edge of the lake, and then both fell into the water, where they continued their struggle with renewed ferocity.

They fought long and hard, thrashing the water with mighty strokes and uttering fearful sounds, until, at last, Brontosaurus began to grow weak, became quiet for a moment, then sank beneath the waves. The victorious Allosaurus soon left the scene of the conflict, swimming away with an ease that showed he had suffered little injury in the fierce encounter through which he had just passed.

Now it happened that later the huge body of the dead Dinosaur rose to the surface of the lake and floated there. The action of the air on the flesh, the heat of the sun, and the greediness of many creatures living in the water, caused all of the soft parts of the body to disappear leaving only the bones. Some of these were broken by the teeth of ferocious monsters and scattered in fragments, hither and thither. But many other parts of the skeleton fell to the bottom of the lake, where they sank into the mud.

Because this mud was soft and very thick it gradually closed tight over the bones, making a covering for them through which the air could not penetrate. Had it been possible for the air to reach the skeleton, it would have decayed and crumbled to pieces. But the mud kept every bone secure from harm.

Time passed until all the animals which had been living when this Dinosaur was vanquished in his fight were dead. Other animals took their places in the world and lived out their lives, and in their turn died, to be followed by still other animals. And

so life on this earth continued, one generation of animals succeeding another, until thousands upon thousands of centuries had passed. And all this time, the bones of the Dinosaur lay sealed in their tomb at the bottom of the lake.

But a change had taken place in that tomb, a change so wonderful it may well be described as one of Nature's most beautiful miracles. Day after day, during all the tens of thousands of years the bones had been lying buried, the earth along the shores of the lake was being washed into the water in tiny particles and, in times of storm, the streams flowing into it were brown with mud. Large quantities of this mud from the shores and the streams settled to the bottom of the lake, and, in this way, the covering over the Dinosaur's bones became deeper with each succeeding year. Occasionally, also, the bones of other animals, which had died in the lake or had been washed into it after they had died on shore, settled into the muddy bottom. Even when twigs and leaves from the vegetation growing along the banks fell into the water some of them found their way, slowly and gently, to this same tomb of mud.

And all these bones and leaves and twigs as they lay at the bottom of the lake were covered up by other mud that was washed into the water just as the Dinosaur's bones had been covered.

Through all this time the miracle was taking place. For the weight of the water on the mud at the bottom of the lake was causing that mud constantly to become a thicker and harder mass. The enormous pressure cemented the tiny particles together until they turned to stone. And this is the way many rocks in which bones are found buried were formed, — by the long-continued pressure of water on mud, or sand, or millions of tiny shells. Other rocks containing bones were formed through different processes equally mysterious, and always this marvelous change was wrought in some way by the action of water.

But this changing of the mud into stone was not all of the miracle that took place in the Dinosaur's tomb. Not even the most delicate parts of his skeleton were broken while this change was going on. When he sank beneath the waves, this creature's mouth had been partly open and at the time that his

(37) *Restoration by Clement B. Davis*

THE DEAD DINOSAUR AFTER THE BATTLE

skull was buried in the mud the jaws were still apart, leaving the teeth exposed. But, although the weight of the water was sufficient to cement the mud into solid rock, the teeth in this skull were not even bent. For, just as rapidly as the mud had turned to stone, so had the bones within them been changed into the same material. How this could happen no one has ever been able to explain. We are told that as the animal matter in all such buried bones disappears, its place is taken by lime and silica, but how this change comes about we do not know. It remains one of Nature's many beautiful mysteries.

Thus it was, that, after countless years, the bones of the Dinosaur which had fought for its life in this lake were changed into what is called a "fossil" and lay imbedded in the solid rock beneath the water. All the other things, whether they were bones, or twigs, or leaves, that had fallen into the mud soon after the Dinosaur had died, had been turned to fossils also. And as more mud was carried into the lake and settled to the bottom, more animals and leaves and twigs found their way into this mud, and, in this manner, layer after layer of rocks containing

fossils were formed above those in which the Dinosaur lay buried.

If the earth had never changed in any way, no one would ever have known that the mighty Dinosaur was in this rocky tomb. But it happens that the earth is ever changing, occasionally because of violent earthquakes, and constantly through the action of the waters that beat against the shores and the effects of rain and wind, heat and cold.

So, as the ages passed, changes began to take place in this lake. Such vast quantities of mud and sand had been carried into it that the bottom rose higher and higher until the water that once had been so deep became very shallow. The land in all the region round about was changing also, and ravines were formed through which the water from the lake ran in rivers. In this way all the water at last disappeared, leaving the lake dry. And by this time, through the upheaval and sinking of the land, the bones of the Dinosaur which had lost its life in the lake, millions of years before, lay buried in the solid rock five thousand feet below the surface of the earth.

No human being had yet lived upon the earth when this lake disappeared and the rock which had formed beneath its waters became dry land. Many thousands of years were yet to pass before man appeared. And during those years great crevices opened in the rock because the earth was continually stretching and contracting, and deep cañons were cut out by the waters. In other places huge masses of rock were tumbled together in confused heaps. These changes continued until even that deep portion of the stone where the Dinosaur was entombed was exposed to view.

After the wind and rain and sand had beat against this rock for many centuries, the surface began to wear away; and, after another period of time which no man can rightly estimate, some of the Dinosaur's bones became visible. But there was no danger of their falling from out the rock, even if it broke into fragments; for they were a part of the stone, only a little different from it in color and texture.

In many of the rocks surrounding the tomb of the Dinosaur were the twigs and leaves and the bones of the other animals which had fallen into that ancient

lake and been buried at the bottom and turned to fossils. And they and the Dinosaur would all be lying in those same rocks to-day were it not that after man had been in this world for many centuries, it was discovered that the history of the life that was lived on this earth before human beings existed was sealed up in the rocks throughout the world.

Determined to read this history through studying these rocks and the secrets buried within them, certain men found a way to open the rocks and take the fossils from them without injury. They also learned how to put the skeletons of the animals together just as they were in life. And because they could do this it has come to pass that the fossilized bones of the Dinosaur, which, millions of years ago, were buried at the bottom of a lake that long since disappeared, have been made into a skeleton and are on exhibition in a museum.

How all this was done is another wonderful story.

HOW THE DINOSAUR WAS
TAKEN FROM THE ROCK

(44)

CAMP OF THE FOSSIL HUNTERS

(Field Photograph, American Museum of Natural History)

HOW THE DINOSAUR WAS TAKEN FROM THE ROCK

ON a midsummer's day a few years ago, three men started out from a large museum in the United States to hunt for fossils. They traveled without stopping until they reached Medicine Bow in Wyoming, which was the nearest they could get to their destination by rail; and here they immediately began making preparations for the rest of their journey.

First they found a man who could cook for them. Then they engaged a couple of laborers to do their heavy work. After this much had been accomplished, they hired a wagon with two strong horses to draw it, and three saddle horses for themselves. They also bought food supplies and whatever was necessary for a camp outfit in addition to the things they had brought with them from the East.

When everything was in readiness, the entire party started on the tedious journey into the fossil

region. The three men from the museum rode horseback while the others found places in the wagon. The weather was hot, and the farther they went the hotter it became. The roads were rough and dusty and sometimes little more than a trail. When, toward the end of the second day, they came within sight of their goal, they were thankful, although the country was a barren spot fit only for sheep grazing. They chose for the site of their camp a little stretch of grassy ground near a narrow stream of water. It was not such water as they could have found in a country filled with verdure, for it was unpleasant to the taste and not even good to look upon; but it was the best there was, and so they were satisfied.

Soon the tents were pitched, after which a quantity of the sagebrush, growing everywhere about, was gathered for a fire. As this brush burns like tinder, there was soon a roaring blaze. Supper was cooked and eaten with a relish, although the fare was of the plainest. By this time the sun had disappeared and the air had become filled with a chilliness that made the three men glad to sit close to the fire, smoking their pipes, sometimes telling

stories to one another, then again falling silent, watching the leaping flames.

All round about were hills, the rocky sides of which were seamed and jagged. It was a forbidding land and one in which no man would choose to live. Save for the voices of the men around the fire, the occasional shouting of the "wrangler" as he cared for the horses, and the frequent yelping of the coyotes in the distance, the whole region was silent.

Yet ages before, this same region had been filled with strange sounds made by the voices of mighty animals. For this was the place where once had been the lake in which the great Dinosaur lost his life in a fight with another of his kind. And all the rocks in the hills and ground had once been the mud that lay at the bottom of that lake and in which the Dinosaur and many other creatures had been entombed.

Knowing that these rocks were full of the history of past ages, these three men had come out to search among them in the hope of finding the bones of some creature which would add a new chapter to that

history. So, early the next morning, they were up and about their work.

Now, the only way it can be known that a rock contains a fossil is when a portion of that fossil shows on the surface of the rock. This portion may be so small, and look so much like the rock, that one not experienced in fossil hunting would never see it. But the eye of the man accustomed to this work is so trained that he can detect the slightest indication of a buried bone as soon as he catches sight of it. As countless rocks containing fossils do not show any such indication, and probably never will, the creatures which lie buried within them will forever remain undiscovered. It is very possible that many a picnic lunch has been merrily eaten off a rock in which a skull, or a foot, or some other portion of a gigantic animal is buried, or perhaps the entire skeleton of a smaller creature. Even the foundation stones of our homes, or the sidewalks in front of them, may hold the bones of animals unlike any with which we are familiar to-day.

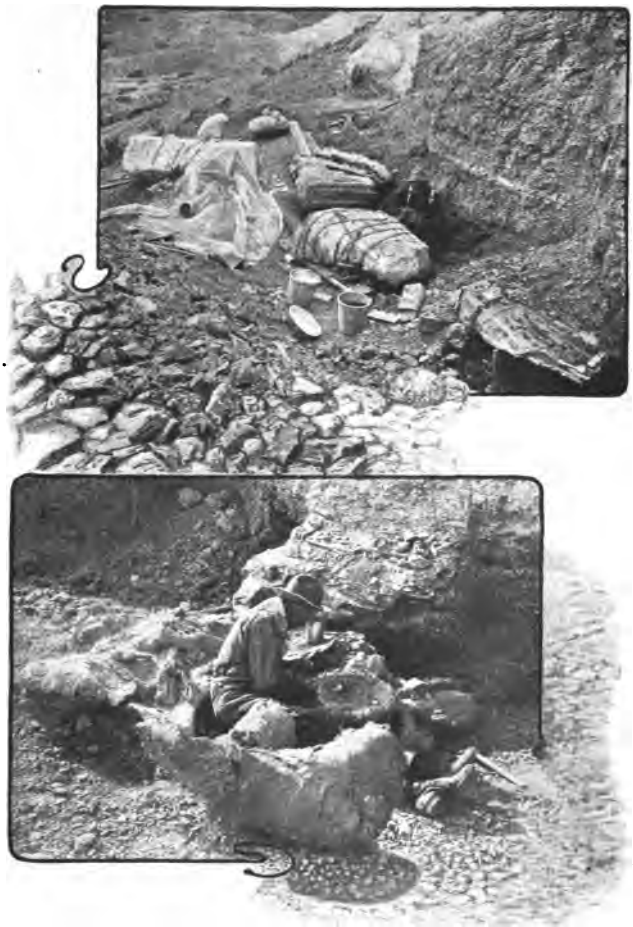
But there are some sections of the world where the surfaces of many of the rocks have worn away until

the bones within them are visible, and such a place is the region in Wyoming where these three men made their camp. For days, however, after they began their search for fossils, it looked as though they were going to meet with nothing but failure. They hunted on foot and they hunted on horseback, sometimes all keeping together, sometimes each man going alone, but they found nothing of enough value to ship back to the museum that had sent them on their expedition. They finally decided that unless a discovery was made within the next few days, they would break camp and move to some other locality where, perhaps, they would find a richer hunting ground.

The next day found them all at work again, each man taking a separate route. Late in the afternoon as one of them was making his way back to camp on foot, exhausted in body and discouraged in mind, he suddenly stopped and stared at a rock jutting out at the base of a bluff on his right. There, plainly visible in the tomb within which it had been sealed many millions of years before, was the half-open mouth of the Dinosaur which had died in the lake while fighting so valiantly for his life.

With a bound the man reached the rock. It took him but a short time to decide that he had discovered the head of some gigantic Dinosaur. He looked about him to see if any other part of the skeleton was in sight. Soon he came upon a rock in which was a section of the backbone. Then he gave up further search and hurried back to the camp. There he found his two companions who, having met with no success in their day's work, had concluded that it would be better to move the camp the next morning. When they heard the story of the third man they were as delighted as they were surprised and all turned in to sleep early so that they might begin the next day's work in good season.

The following morning, soon after sunrise, they were at the spot where the Dinosaur's jaws were visible, eagerly searching for more signs of the buried monster. But not a vestige of bone could be seen aside from the jaws and the piece of backbone the man had found the previous evening. So the men concluded that the skeleton, if it existed, must extend back into the bluff. The only way to find out whether or not they were correct in their guess was



REMOVING AND PREPARING FOSSILS FOR SHIPMENT

(51) (Field Photographs, American Museum of Natural History)

to dig into the hillside. This meant heroic labor, for, as the rock was hard instead of being somewhat soft, as is often the case with the rock in which Dinosaurs are found buried, the cutting away of the stone was a difficult undertaking.

After the rock containing the skull had been loosened from the hillside and signs of other bones were revealed, the men felt reasonably confident that a large part of the Dinosaur's skeleton would be found extending back into the bluff. To get it all out would mean at least a year of work and perhaps two years. So preparations were made for a long stay in this desolate region, where there was no hope of their seeing any other human beings except an occasional sheep herder or cowboy. Two men were sent back to Medicine Bow to get some extra supplies and mail a report of the discovery to the museum. Soon after this every man in the party had settled down to his long task.

Presently it was found that it would be necessary to make a tunnel into the bluff in order to reach the bones. Knowing from past experience that such a method might have to be adopted, the men had

brought gunpowder with them, and as every collector is expected to know how to blast, the tunnel was soon being opened up.

As the work progressed a drawing was made by the head man of the party that showed the location of every rock before it was taken from the bluff. Then, as each piece of rock was removed, strips of burlap wet in plaster of Paris were wrapped around it, and after the plaster had dried, the burlap made a safe covering for the stone. As soon as a rock had been thus protected it was numbered in the order in which it had been found among the other rocks. This was done so that when the men in the museum unpacked these various rocks, they could put them together according to the numbers, number two joining number one, number three joining number two, and in this way the rocks would be laid out in the museum in the same position in which they had been discovered.

While working their way into the bluff the men did not, of course, find the bones of the Dinosaur arranged just as they had been in life. As some of them had been torn from the skeleton by vicious creatures

when it floated on the surface of the lake millions of years before, and as these pieces had been carried far off and lost, the entire skeleton could never be found. But, considering the devastation that is always wrought by living creatures in all such skeletons before they are buried, and the many changes that occur in the earth after their burial, the bones of this Dinosaur were discovered in unusually good shape.

Slowly, but surely, the bluff was made to yield up to man this animal which had died ages before any man had lived. To recount all that it was necessary to do in order to recover the skeleton would be to tell of many months in which every day was filled with the hardest kind of labor. Some of the rock was removed in sections that weighed two tons; and to handle these was a serious undertaking when the tools and appliances at hand were not many.

But there came a day, about a year after the Dinosaur had been found, when it was decided that all of the skeleton which was in that locality was unearthed. After every piece of rock had been wrapped and numbered and then securely boxed, the

(55)

TAKING THE FOSSIL FROM THE BLUFF

(Field Photograph, American Museum of Natural History)

work of transferring the boxes to Medicine Bow began. It took many trips of the wagon before this task was accomplished. Back and forth in the blazing sun, went the sturdy horses patiently pulling the load that contained the skeleton of a creature which, long before any kind of a horse had lived, was monarch of this very region. Finally all the boxes were safely packed in a freight car, and then the Dinosaur started on his long journey.

The train sped swiftly eastward, through a country far different from anything in existence during the Dinosaur's lifetime, and when, at last, the engine pulled the car containing the bones of this ex-monarch into the station of the city which was thereafter to be his home, he had traveled more than two thousand miles.

Although the Dinosaur was so unlike any animal which any person had ever seen alive, the men into whose charge the rocks containing his bones were given when they reached the museum knew a great deal about how he had looked in life. Soon they were at work getting the pieces of rock in order so that the bones could be taken from them. All

these pieces were arranged according to the numbers with which they were marked. As each rock was put into its place the diagram made by the man in the field was consulted. Every rock fitted just as the diagram showed it should, and this proved that the work of collecting had been well done. Sometimes a collector is careless in this part of his work, and this carelessness not only makes endless trouble for those who take the bones from the rock, but injures the collector's reputation as well.

And now, at last, the men were ready to free the skeleton from the rock, a work that would require from one to three years to accomplish, according to the difficulties they should meet as they progressed. Only men who knew the formation of the bones of the Dinosaur as well as a surgeon knows the formation of the bones in the human body, could be trusted with this undertaking. But, as there were in this museum some of the most capable men in the world in this sort of work, there was no delay in beginning the task of taking the Dinosaur from his tomb.

Carefully, with delicate strokes of various-sized hammers on various-sized chisels, the men chipped

the rock away from the fossil. The man who worked on the rock in which nothing was visible but the grinning jaws knew that he would be likely to find all of the Dinosaur's skull within the stone. But how was he to get this skull out without breaking it with his chisel? He could avoid this disaster because he knew so well how the bones in the heads of different Dinosaurs are shaped. The position of the jaw helped him to understand where the rest of the head lay. Of course, this head might be found in a shattered condition, and if so, he would be obliged to work all the more cautiously in order to recover every fragment so that after all the bones had been freed from the rock, they could be cemented together into a skull.

But this Dinosaur's head proved to be remarkably well preserved, without a bone displaced. It took many weeks to get it from the rock, but, as the stone was chipped off, a little more each day, the skull emerged farther and farther from its tomb and took on an appearance of life that was thrilling to watch. There was a fierceness in the set of the open jaws that spoke of this creature's violent sensa-

tions as he went down to death. And when, nearly two years later, all of the skeleton had been taken from the rock, marks were found upon it showing where the teeth of his enemy had pierced the Dinosaur to the bone.

While chipping the skeleton from its tomb the men had occasionally come across pieces of bone that once were parts of other animals which had been buried in the mud at the bottom of the lake about the same time that the Dinosaur was buried. They also found some of the twigs and leaves that had fallen into the lake and had been turned to fossils in the same mud. All these bones and twigs and leaves made it possible for them to know what kind of vegetation grew on the shores of the lake in which the Dinosaur had died, and also something about the animals which were his neighbors.

The character of all these fossils and the formation of the rocks that contained them, as well as the position of those rocks in the bluff in which they were found, all helped the men who worked over this Dinosaur to gain an idea of how long a time had passed since his death. To be able to judge of the

age of fossils is in itself a science and one which is every year advancing.

After all the bones of the Dinosaur had been freed from their prisons, there was still much to do before the skeleton could be put together. Certain parts were missing and these had to be made out of plaster of Paris. Some of the ribs on one side were lacking, but it was not a difficult matter to replace them with artificial ones exactly like the ribs on the other side. As there was but one hind foot, another was made to match it. A portion of one of the front legs had to be pieced out; but there was less of such work to be done on this skeleton than is usually the case with such large specimens.

All the necessary pieces having been supplied, the men put the skeleton together just as it had been in life. Their knowledge of living animals was an aid to them in this part of their work, for, while this Dinosaur was different from any animal ever seen by man, he still had a head and neck, a backbone and a tail, legs and feet, and these were joined together much after the manner of living animals. So, the more a man who prepares one of these fossil skeletons

(61) "CAREFULLY, THE MEN CHIPPED THE ROCK AWAY FROM THE FOSSIL"

(Photograph from the American Museum of Natural History)

for exhibition knows about the skeletons of living creatures, the better skilled is he in his work.

Piece by piece the bones of this monarch of other days were adjusted until at last he stood upright on his huge feet, his body more than twice as tall as the tallest man and over seventy feet in length. Iron braces were used to support the monster when he was placed on a platform in the main exhibition room of the museum.

Thus it was that the bones of the Dinosaur which had been killed ages before any human being lived found a home in a great city where each year many thousands of people would look at him with amazement. And all round about him in this same museum were the skeletons of other animals which had lived before man. Some of them had made their homes on the land, some in the air, some in the water. Many among them had been rulers in their time just as had the Dinosaur in his. And how these rulers looked when alive, and where they lived, and how they were at last found in their rocky tombs, are stories well worth the telling.

DESPOTS OF THE SEAS

(64) *Restoration by Charles Knight*

ICHTHYOSAURS

(After H. F. Osborn. Original in American Museum of Natural History)

DESPOTS OF THE SEAS

DURING the same time that the Dinosaurs were the tyrants of the land the seas also had their despots and among the mightiest of these was the Ichthyosaur or Fish-Lizard, to call him by his English name.

Like the seas of to-day, those in which the Ichthyosaurs swam were a world in themselves. Their population was made up of many kinds of creatures, big and little, weak and strong, all of which had to find their own food. So they ate one another, and sad was the fate of the weak and timid among them. Immense quantities of fishes were, we may be sure, devoured by the greedy Ichthyosaur, and he must have caught his prey rather easily, for he was the swiftest swimmer of his time. Although he had two pairs of paddles, his broad and strong tail was the chief means by which he propelled himself through the water at express-train speed. And terrible was

the fate of any creature unfortunate enough to get in his way.

There was once a man who, in trying to describe an Ichthyosaur, wrote this jingle: —

"Behold a strange monster our wonder engages,
If dolphin or lizard your wit may defy,
Some thirty feet long on the shore of Lyme-Regis,
With a saw for a jaw and a big staring eye.
A fish or a lizard? An Ichthyosaurus,
With a big goggle eye and a very small brain,
And paddles like mill-wheels in clattering chorus,
Smiting tremendous the dread-sounding main."

We may know from this that the Ichthyosaur was not a pretty object to look at and that he was a creature of gigantic size and strength.

This mighty Fish-Lizard had immense eyes, round and glaring, and an enormous jaw that sometimes contained as many as two hundred and forty sharp teeth. But this jaw was only a part of his fearful head which was frequently five and a half feet in length. Other Ichthyosaurs, even when full grown, did not measure more than this from the tip of the tail to the end of the jaw, and it is quite possible

that the big Ichthyosaurs often made a meal of these small relations of theirs. We would hardly call a fish five feet long small if we tried to eat it; but to the voracious Ichthyosaurs, a creature of this size probably seemed nothing more than a light lunch.

All of the Ichthyosaurs, large and small, are believed to have had a smooth skin, for no scales have ever been found lying near any of their skeletons. Large numbers of these skeletons have been discovered and are now to be seen in museums throughout the world. But it was a long time after the first Ichthyosaur was dug out of the rocks some two hundred years ago, before any one could make out what sort of creature it was. Then, about the year 1814, it was learned that the bones were those of some monster which had lived in the water millions of years before the time of man.

It is thought that the Ichthyosaur was descended from some land animal. For we know that as the earth slowly changed in its climate and vegetation, the animals living upon it had to change their habits. The species which were not able to do this gradually died off until they entirely

disappeared. But other species which were more fortunate lived through these changes, although, in doing so, their whole manner of life was altered and also their forms. When some of the land animals could no longer get enough to eat on the land, they found food in the water and, after many generations, became water animals. Some of the ancestors of the Ichthyosaur were probably thus driven from the land to keep themselves from starvation. This was what happened to the ancestors of the whale and seal of to-day, for these creatures are descended from land animals. But it took centuries upon centuries for land animals to become so adapted to the water that they could live in it entirely.

When in the full glory of their power, the Ichthyosaurs swarmed in the waters of Europe, India, Australia, New Zealand, and the east coast of Africa; but they were not so numerous in America. Yet, mighty as they were, they did not maintain their position as rulers of all these waters without some trouble; for they had many dangerous enemies, among which were the Plesiosaurs.

The Plesiosaur did not look at all like the Ichthyosaur. He had a thick body, short tail, four very strong and large paddles, a remarkably long neck, and a small flat head somewhat like that of a snake. Some one once said that this creature looked like a snake threaded through the body of a turtle. But the name given him is in no way connected with snakes or turtles, for Plesiosaur means "near to a lizard."

When swimming, the Plesiosaur could stretch his long neck far above the water; and many a little flying creature which happened to come within reach of his cruel, toothed jaws met a quick death. When his head was below the surface he could twist his neck in all directions, looking for enemies, and this gave him an advantage over the Ichthyosaur, which had a very short neck. But, when it came to a downright fight between the two, the Ichthyosaur had the advantage, for he was swifter in his movements than the Plesiosaur and stronger of muscle. Yet he did not always win the battle, although when he charged upon his foe with jaws set ready to sink those two hundred forty teeth

into him, things must have looked bad for the Plesiosaur. Great was the commotion when the two met, nor would either give up the combat until one was dead. For they were both mighty creatures, and each was determined to be king of all the animals then living in the water.

There came a time, however, when both the Ichthyosaurs and the Plesiosaurs began to disappear. Then the sea serpents became the rulers of the waters throughout the world. Nowadays no one believes in sea serpents, and a sailor who claims he has seen one is laughed at. But millions of years ago, if there had been any sailors living, they might have seen large numbers of such serpents from six to forty feet in length, wherever they happened to sail. They would have seen more of them in America than in any other country, and especially in the seas that then covered Kansas and Nebraska. And the waters that filled the space now occupied by New Jersey, Alabama, North Carolina, and Mississippi were also inhabited by these serpents, but not in such large numbers as were the western waters.

(71) *Restoration by Charles Knight*.

MOSASAUR

(After H. F. Osborn. Original in American Museum of Natural History)

The name Mosasaur has been given these creatures because it was in Belgium, in the valley of the river Meuse, that the first one was discovered. The words Meuse and "saurus," which is Greek for lizard, were made into Mosasaur. Some workmen who were blasting the rocks underneath one of the mountains in this region were astounded when, after they had set off a blast in a cavern, they saw the jaws of some animal imbedded in the roof. They immediately reported their discovery, and a Dutch military surgeon who was interested in collecting fossils hurried to the spot. He knew in a short time that the bones were those of some animal different from any then living. Soon he had men at work removing the precious discovery and was overjoyed to find that almost an entire skeleton was buried in the rock. The bones were taken to the near-by city of Maestricht, where they were received with great enthusiasm. It was not long before the fame of this fossil spread over Europe, and the people of Maestricht felt very proud to have it in their possession.

Twenty-four years later, in 1794, during the

French Revolution, the French, under Kleber, besieged Maestricht. But orders were given not to fire on the building that contained the Mosasaur. Kleber was determined to take this celebrated fossil back to France with him, and he was anxious that it should not be injured during the bombardment. After he had captured the town, he demanded the skeleton as one of the prizes of victory. There was nothing for the Maestricht authorities to do but to give up the cherished treasure, and Kleber carried it off in triumph to Paris, where it still remains and is one of the most valued exhibits in the zoölogical gardens.

When this Mosasaur was alive he had a long, snakelike body covered with scales, a long tail, and a slender flat head. His jaws opened very wide, and his throat was so baggy that he could swallow his food whole. When, in his greediness, he put too much in his mouth at once, he used his under jaw as though it were an arm and pushed the food down his throat. By extending the arms at full length with the palms of the hands touching and then bending the elbows in and out one can

gain a very good idea of how this jaw worked. Then, to make matters worse for his prey, the Mosasaur had many sharp teeth. So what chance of escape did any fish have when once he had been captured by this sea serpent?

Although the Mosasaur was provided with four paddles, which he used in swimming, two on each side of his body, his tail was the engine on which he relied for speed. As he made his way with lightning-like rapidity through the water, now gliding straight ahead, now twisting and turning, now diving suddenly toward the bottom, then rushing up again to the surface, all creatures of less strength must have hastened to their hiding places. Even the gigantic turtles which were living in those same waters very likely made it a point to get out of the way when they saw a Mosasaur headed in their direction.

And a greater panic than this must have seized all these creatures when an Elasmosaur got angry or started out on a search for a meal. For the Elasmosaur was even longer and mightier than the Mosasaur, which he closely resembled, although he

(75) *Restoration by Charles Knight*

ELASMOSAUR

(After H. F. Osborn. Original in American Museum of Natural History)

was really a distant relative of the Plesiosaur. So powerful was this creature that wherever he went he left destruction in his path.

When a number of Mosasaurs or Elasmosaurs got together to fight or to frolic there must have been a tremendous splashing. But they fought far more than they frolicked, for in those days life was one constant warfare in which the big animals battled to keep their positions as rulers, and the smaller ones to save themselves from utter destruction.

Then, after a time, all these sea monsters completely disappeared. Even the waters in which they lived have vanished and in place of them are cities and towns, villages and farmlands. And so, to-day, people by the thousands are living where once these despots made their homes.

FLYING REPTILES
C. R. DAVIS

(78) *Restoration by Clement B. Davis*

PTERODACTYLS SEEKING FOOD ON THE CLIFFS

THE FLYING REPTILES

AMONG the many wonderful creatures flying through the air in those days when there were no people in the world were the reptiles called Pterodactyls. The outspread wings of the largest of these monsters measured twenty feet from tip to tip. No animal has ever flown through the air since man lived on earth which could compare with this in size.

Even the bravest among the Dinosaurs must have felt some fear when he saw one of these gigantic creatures hovering over his head. And a Plesiosaur, swimming with his neck stretched far above the water, probably had cause for watching warily when a big Pterodactyl came near him. For, although these flying reptiles did not eat the big land-and-water animals, we may be sure they were quite ready at times to do battle with them.

Some of these mighty rulers of the air had long

and narrow heads ending in beaks a foot and a half in length. These Pterodactyls were toothless, but others with short heads and beaks had very sharp teeth, which they put to cruel use when fighting as well as when catching the small animals on which they fed. However, not all of the Pterodactyls were large. They varied greatly in size, some being no bigger than crows. But they, every one, had four legs, each ending in four fingers, and because the outside finger of each front leg was fastened to the wing and grew its entire length, these creatures were named Wing-Fingered—only, instead of using the English words, men have taken two Greek words, "pteron" (wing) and "dactylos" (finger), and made the name Pterodactyl.

The eyes of these flying reptiles were so large it is thought they may have gone about mostly at night, as do the bats and owls of to-day. But whether the long-necked, long-headed Pterodactyl went about by night or by day, it was easy for him to see in all directions without turning his body. If he suspected that he was being followed by an enemy, he could look behind him without

for a moment stopping his rapid flight forward. This was because his neck was so flexible he could twist it around until the tip of his beak pointed straight toward the tip of his tail. For Pterodactyls had tails, some of which were very long, others very short, and many of medium length. The long tails suddenly broadened at the end into a shape like that of a leaf. This would lead one to think that they were used as rudders in flying. As he traveled through the air the long-tailed Pterodactyl must have been an alarming sight with his wicked-looking head, his wings spreading out on either side of his bat-like body, and his tail stretching far behind him.

If such a Pterodactyl was a terrifying sight when flying, he must surely have been a laughable one when on the land. For there seems to have been no way for him to walk about except on his hind legs, with his great head curved far backward so as to keep his balance. If he covered the ground very rapidly while in this position, he was certainly more intelligent than he looked. But he probably did not descend to land for the sake of running

about, but rather that he might crawl around in search of small animals to eat, and in the thousands of insects flitting back and forth he found plenty of daintier food. He may, also, now and then, have foraged for a meal of birds' eggs up and down the sides of cliffs to which he could cling with the sharp claws on the ends of his fingers.

But it is supposed that the Pterodactyl fed mostly on the fishes with which the lakes and seas abounded. Greedily he hovered over the water, watching until a fish ventured too near the surface. Then down would swoop the monster to snap up his victim in his savage beak. Or, at other times, he may have rowed himself over the water with his powerful wings, using the wing membrane, as does the bat, to grasp his prey and carry it to his mouth. But, to judge from his weight, the Pterodactyl was not a very large eater. One species, the head of which alone measured nearly four feet in length, did not weigh more than twenty-five pounds, and his largest finger bones, although two feet long and six inches in circumference, were almost as thin as paper!

No one knows just how the Pterodactyls raised

(83) *Restoration by Charles Knight*

PTERODACTYLS

(After H. F. Osborn. Original in American Museum of Natural History)

their families. Perhaps they built nests in which to hatch their eggs, or they may have buried the eggs in the sand where they were hatched by the sun. Some day we shall probably learn more about the family life of these strange creatures, for their bones are continually being found and studied.

It was in Bavaria, in the year 1784, that the first bones were discovered. But no one could make out whether they were part of an animal which had lived on the land, in the water, or in the air. Then, twenty-five years later, these bones were examined by Cuvier, the celebrated French naturalist, and he was able to prove that they belonged to some extraordinary flying creature. Since then it has been learned that these winged reptiles made their homes in nearly every part of the world, but they lived in Europe many centuries before they found their way to America. Just how they got here no one can tell, but once they had arrived, they increased greatly in size and numbers. They lived around the inland sea that was then part of the western United States, and in Kansas their bones have been found in abundance.

Nor were the Pterodactyls the only creatures flying

around that western sea. There were birds, similar to those now living, and there were also other very queer birds with teeth. Then there were myriads of insects like dragon flies, locusts, and moths. But as long as they lived, the Pterodactyls held undisputed sway over all other inhabitants of the air the world over.

What a scene it must have been upon which these mighty rulers looked down as they flew hither and thither! Great stretches of water, in which swam sea serpents and other astonishing forms; swampy expanses of land, over which Dinosaurs walked by the thousands and gigantic crocodiles and tortoises crawled. And amid all this teeming life there was not one human being.

THE LITTLE-BRAINED DINOCERAS

(88)

DESERT IN SOUTHWESTERN WYOMING

(Field Photograph, American Museum of Natural History)

THE LITTLE-BRAINED DINOCERAS

ALL of the Dinosaurs and Ichthyosaurs, the Plesiosaurs, the sea serpents, and the flying reptiles, had been dead for hundreds of thousands of years when a mighty animal different from any which had ever lived before appeared in the western part of the United States. Nor is anything like it living now.

Because he had six horns on his head this animal has been called Dinoceras which is Greek for Terrible Horn. These horns, which were something like knobs, were arranged in pairs. The smallest pair stood on top of the nose, the second pair a little behind them, while the third and largest pair was at the very back of the head. And then, in addition to all these unbecoming decorations, the Dinoceras had two enormous teeth in his upper jaw that grew downward like tusks. They were exceedingly sharp and often seven or eight inches in length.

But there was something about this beast much more curious than the horns and tusks he carried

on the outside of his head. This was the brain he carried inside of it. For the Dinoceras had the smallest brain in proportion to his size of any land animal so far known. The body of a man weighs only thirty-five times as much as his brain. The body of the Dinoceras was four thousand times heavier than his brain. What a stupid creature he must have been! Probably he was provided with his horns and his tusks so that he could protect himself against the attacks of other animals, which, though smaller than he, were larger-brained and therefore quicker in their movements, and more cunning. In his combats with these brainier animals the Dinoceras for a long time came out the victor. Had it been otherwise, these horned monsters which were about the size of a big rhinoceros could not have lived in such large numbers for many hundreds, perhaps even thousands, of years. But, as they finally all disappeared from the earth, it is natural to suppose that the bigger-brained animals at last conquered them.

The only place where the Dinoceras has been discovered is the desert that occupies southwestern

Wyoming and northeastern Utah. Nothing more desolate than this whole region can be imagined, for it is made up entirely of rocks. And within these rocks lie buried the bones of countless animals. Professor O. C. Marsh was the first man who ventured to explore this vast cemetery in search of these bones. He was rewarded by discovering the Dinoceras which, at first, was given the name Uintatherium — Uinta Animal — because it was found in the Uinta rock formation, and in some museums and books this name is still used. Before he succeeded in taking any fossils from the desert, Professor Marsh had many an exciting experience. For the Indians living near by believed that these fossils were the bones of their ancestors whom they worshiped. So they started some spirited fights in their efforts to keep the white men out of this old burial ground.

For many generations the Indians who passed through this desert had told wonderful tales of gigantic skulls and legs and feet which they had seen sticking out of the rocks. Sometimes an Indian who had been in the desert many times would insist that these bones were pushing themselves farther

and farther from out the stone. A skull which, a few years before, showed little more than the grinning mouth with its ferocious-looking teeth, had, so this Indian would say, made its way out of the stone until much of the head was visible. Neither he nor any of the Indians who heard his tale knew that it was the wearing away of the rock that had caused the skeleton to come into plainer view. They all supposed that through some miracle the bones of their gigantic ancestors were rising from their tombs.

So it is no wonder the Indians objected to any one going into the desert to disturb these bones. They were horrified when they saw the white men take up great rocks containing skeletons and cart them away to be shipped to museums. In the hope of saving their forefathers from such an ignoble fate the Indians fought valiantly with tomahawk and arrow. So hostile were they that it was necessary at one time for Professor Marsh to take an escort of United States troops into the desert with him. Even to-day the hunter for bones in this region is likely to come upon a troublesome Indian; for many of the red

men have never ceased to resent the invasion of the white men into this locality. It is not possible to convince them that the buried skeletons are the bones of animals and not of human beings. But in spite of opposition on the part of the Indians, many skeletons of the Dinoceras have been taken from these rocks. So far no skin has ever been found with these skeletons, but there is reason for believing that Terrible Horn was covered with a skin like that of the living elephant or rhinoceros.

The desert in which these creatures are found was once a beautiful country consisting of a chain of inland seas, on the shores of which grew tropical vegetation. Vast numbers of gigantic animals and smaller ones as well lived in these seas and the surrounding country for many tens of thousands of years. During all that time the waters were salt and connected with the ocean on the west. But the bottoms of some of the seas were slowly rising. After many thousands of centuries, they had risen so high they began to form small mountains. These mountains, through the changes that later took place on this continent, became the towering ranges

now to be seen in the western part of the United States.

As the bottoms of the seas rose, the seas themselves disappeared. But there were other seas, the bottoms of which did not rise and form mountains. One of these was in the southwestern part of Wyoming and, as the mountains formed into the Wasatch range on the west and the Rockies on the east, they shut off this sea from the ocean. As thereafter it was fed only by streams of fresh water, it became a fresh-water lake. It was not until all these changes had occurred that the Dinoceras appeared on the shores of this lake, which was about one hundred miles long. The climate was still mild, for the mountains had not then risen high enough to shut off the warm winds from the ocean.

Here, in this luxurious land, the Dinoceras lived for many generations. To-day he is famous, chiefly because of his small brain and the fact that he was one of the first gigantic mammals in the world. For many ages before the time of the Dinoceras, the reptiles had ruled the earth, but after the mammals had once gained the mastery of the reptiles, they

(95) *Restoration by Charles Knight*

DINOCERAS

(After H. F. Osborn. Original in American Museum of Natural History)

never lost it. The reason for this may be that all mammals suckle their young instead of leaving them to feed themselves as best they can, after the manner of the reptiles. And a young animal protected and fed in this way stands a better chance of growing up strong and vigorous than do the young of reptiles. To-day the most powerful animals in the world are mammals while the reptiles have to take a subordinate place.

The kingdom over which the Dinoceras exercised his brute authority was made up of many animals of different forms and sizes. Some were flesh eaters, but most of them, like the Dinoceras, lived on plants and roots. There were big, heavily-built, vicious creatures resembling the bear; and others, less fierce, were somewhat like the tapir. Still others were similar to the cat, the wolf, or the fox. Moles were digging industriously in the earth. Monkeys were swinging from the branches of trees and hiding within the big-leaved foliage. And an ancestor of the horse, no bigger than a fox terrier, was running briskly about. When this small creature happened to get in the pathway of a Dinoceras, he

was crushed to death under one huge foot as easily as a kitten of to-day is crushed by an elephant.

Yet, strange to say, as the centuries passed, this ancestor of the horse, and others among the small animals, grew bigger and stronger and the Dinoceras became less and less powerful until, at last, this little-brained, big-bodied mammal lived no more on the earth.

UNIV. OF
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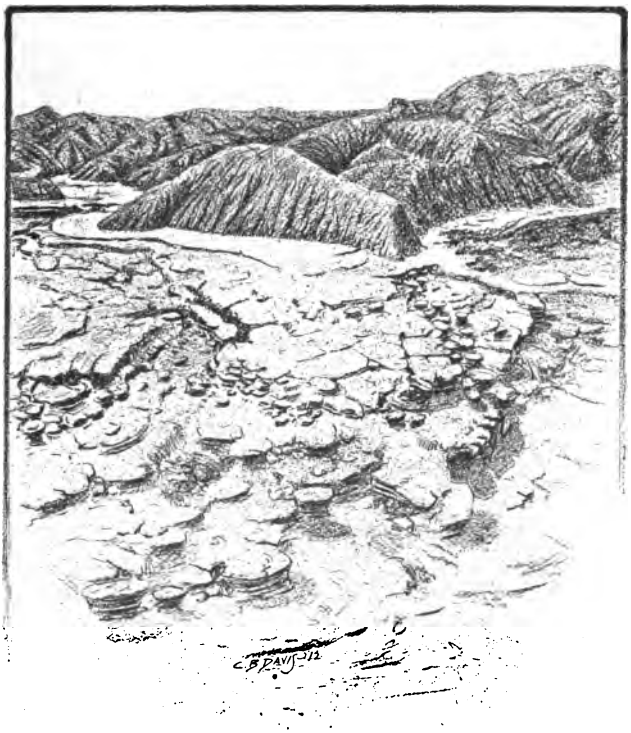
TITANOTHERES AND OTHERS



(181) *Restoration by Charles Knight*

TITANOTHERIUM

(After H. F. Osborn. Original in American Museum of Natural History)

TITANOTHERES AND OTHERS

AFTER the Dinoceras had disappeared from the western part of the United States, there were still many strange animals making their homes in that section of the world. And in no place were they more numerous than the locality in South Dakota now called "The Bad Lands." These lands are well named, for one may walk through them for miles over a floor of rock, and see nothing in any direction but other rocks of fantastic shape and wholly bare of vegetation.

Yet, long ago, it was quite different. There were lakes all through this part of Dakota, and in the country around these lakes grew plants of many kinds. The climate was sunny and warm, and in these congenial surroundings lived numberless animals. Among them were some creatures about the size of a Shetland pony and not at all pleasing in appearance. Their heads were very odd in shape, for in the center of the top was a deep depression just

as there is in a riding saddle. And they all had little stubby knobs sticking up on the tops of their noses.

Of course, after a time, these animals died. But they left descendants. These were a little bigger than the first animals and the knobs on their noses were a little higher. They, in their turn, left descendants which were still larger and had knobs on their noses that were still higher. And so these beasts increased in size, generation after generation, until, at last, they reached a point where they were as large as an elephant. By this time they had stout horns a foot high on their noses, instead of little stubby knobs. For thousands of years these big creatures flourished around the Dakota lakes, then, suddenly, they disappeared completely.

A million years or more after this remarkable disappearance, some men who were searching for fossils in the Dakota Bad Lands came upon the bones of one of these animals near the top of a high bluff. The men were immediately much interested in their discovery, for, although they were experienced fossil hunters, they had never before seen bones like these.

After they had unearthed nearly an entire skeleton, and had sent this skeleton to a museum, where it was taken from the rock, it was seen that a very large animal had been found. So he was named Titanotherium, which means Gigantic Beast.

After this first Titanotherium had been discovered, many fossil hunters from different museums worked industriously to find others, and succeeded even beyond their expectations. Skeletons of these creatures were taken from the bluffs to a depth of one hundred and eighty feet. Below this depth, other animals were found which were just like the Titanotherium, only of smaller size and with shorter horns. This made the fossil hunters all the more eager to continue their search. The result was that the farther down the bluffs they went the smaller were the skeletons they unearthed. At last, after working for many summers, they came upon the Titanotherium's first ancestor, the small creature with the stubby knobs sticking up on the end of his nose! The name Titanothere was given this entire family of animals, but the largest species of that family still goes by the name of Titanotherium. And

fossil hunters are continually working in the Dakota Bad Lands in the hope of making new discoveries concerning all the different members of this strange family of beasts.

It must not be supposed that these different sizes of Titanotheres are found buried in neat layers, one below the other. On the contrary, the different layers are often in different bluffs. But the farther down a layer is in a bluff, the smaller are the animals it contains. So it is known that, from the time the Titanotheres first appeared on earth until they disappeared, they made their homes in this part of Dakota. They lived in other parts of that western country, also, but not in such large numbers as around the lakes that once made beautiful the now dreary and uninhabited Bad Lands.

Tens of thousands of years, yes, perhaps, even a million of years, passed between the time when the first Titanotheres lived and the time when the last of the family — the Titanotherium — became extinct. The general estimate is that it takes nine hundred and ninety-six years for one foot of rock to be formed through the action of water on mud. When we re-

member that the rocks in which the Titanotherium is found extend to a depth of one hundred and eighty feet and that below this one hundred and eighty feet are many deep layers of rocks containing all the other sizes of Titanotheres, we can gain some faint idea of how long this family of animals lived. And we know that they ceased to exist while at the highest point of their growth, because the bones of the largest members of the family are in the upper layer of rocks.

But why did the Titanotheres disappear just at the time when it would seem they were well prepared to hold their own against all odds? This is a question that has puzzled even the most learned among the men who have studied these animals. Some, however, believe that they slowly starved to death. They were plant eaters, and unfortunately for them the climate began to grow cold after they had developed into huge creatures. This meant that the trees and grasses were tougher and less plentiful, and so, as the teeth of the Titanotherium were suited only to the crushing of soft and juicy food, this lumbering, slow-witted beast had a hard time of it. Had he been a larger-brained animal, he might

gradually have found some new way of feeding himself. But, as he had a small sluggish brain, he was incapable of doing this. So, as plants of sturdier growth began to take the place of the tropical food, these poor animals, unable to get enough to nourish their huge bodies, died from weakness. It may have taken many generations for them all to be thus vanquished in life's battle, but their downfall was complete before enough time had passed for them to decrease in size. This may not be the true reason for the disappearance of these animals while they were at the highest point of their development, but it is the best one so far given by those who have made a study of the subject.

After all the Titanotheres were dead, the climate of North America continued to grow colder, but the change was very gradual. The country was still filled with many remarkable animals among which was the Elotherium, a distant and gigantic relative of the pig. He must have caused terror among the smaller animals, for he was a fierce brute. His head was fully a yard long and his sharp teeth show that he lived on both plants and roots. These beasts

wandered by the thousands over the plains of Oregon and as far east as the lake region of South Dakota, where once reigned the Titanotheres. If all the animals then living, hideous though they were, had entered a beauty contest, the Elotherium would have stood a good chance of winning the booby prize.

Animals something like the living camel and llama were in America in those days, strange though it seems to us now. And fiercest among the flesh eaters were the saber-toothed cats, some of which were as large as tigers and had canine teeth seven inches long. Many a time must they have crouched in the shadows, their treacherous eyes gleaming as they waited to pounce on their prey. For they were all vicious and ever on the watch to kill. Then, also, there was a rhinoceros, but it was not much like the rhinoceros of our time. Skeletons of these creatures have been found by the thousands in Kansas, and so grouped as to show that hundreds died together as the result of some terrible disaster. And, living as neighbor to all these big animals, was the ancestor of the horse, which had gained in size

since the time of the Titanotheres, but which still did not look as though he would some day become the most beautiful and valuable animal in the world.

Nor was America the only country inhabited by queer animals during this period in the earth's history. Some very remarkable creatures were then living in Egypt. One of them was the largest mammal of his time. No one ever heard of this beast until 1902, when his bones were found near the palace in which the Egyptian princess, Arsinöe, sister of Cleopatra, used to live. The man who found these bones decided he would name the creature himself. So he added the word "therium" (beast) to Arsinöe and made the name Arsinöitherium. If Arsinöe had been living, he would never have dared do such a thing. For what princess would tolerate having as a namesake an animal over five feet tall, with a short neck, long legs, broad, thick feet, two high broad horns sticking out from his face, and two more short horns above them?

But when the Arsinöitherium was alive there had never been a princess on earth. The pyramids of Egypt seem so old to us we are awed when we think

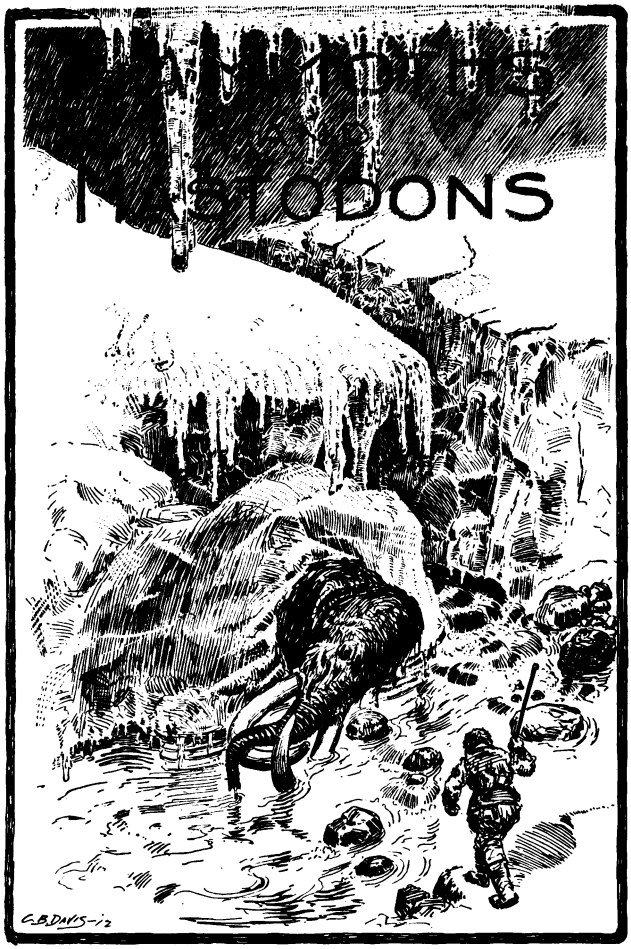
(169) *Restoration by Charles Knight*

ARSINÖITHERIUM

(After H. F. Osborn. Original in American Museum of Natural History)

of them. Yet the Arsinöitherium lived hundreds of thousands of years before the pyramids were built. His bones now lie in a desert, but in his lifetime that same locality was a fertile country and the home of many kinds of animals, most of which were probably his enemies. There were gigantic tortoises, snakes fully sixty feet in length, ostrich-like birds, big crocodiles, river turtles, sea snakes, and whales, as well as some very peculiar beasts which were among the first ancestors of the elephant, although they were but little like the elephants with which we are familiar.

In the course of time many of these animals entirely disappeared and nothing like them has ever since been seen. Others slowly changed in form and developed in size until they became so powerful that they in their turn were the rulers of the earth, just as many other mighty creatures had been before them.


MASTODONS
C.B. DAVIS-12

(112) *Restoration by Charles Knight*

MAMMOTH

(After H. F. Osborn. Original in American Museum of Natural History)

MAMMOTHS AND MASTODONS

SLOWLY, through thousands of years, the elephants developed from small creatures with short trunks and tusks, into animals so powerful that, at last, they were the monarchs of the entire world. Now they live only in Africa and India, and any one in other countries who wishes to see one of these animals must go either to a circus or a zoölogical garden. Yet, in all the places where elephants are at present exhibited as curiosities, they once made their homes. For they lived in nearly every part of Asia and Africa and in Europe and America. There were many different kinds of them, but none were exactly like the elephants of to-day. And mightiest among them all were the Mammoths and the Mastodons.

When men first began to find the fossil bones of elephants buried in the earth, they thought them the bones of human beings. They therefore concluded

that once there were giants in the world. This is the reason there are so many stories about giants in the books written long ago. The Greeks believed that these giants were mighty warriors, and they worshiped them as heroes. Once when they found the knee bone of an elephant they thought it was the knee bone of Ajax, one of the tallest and strongest of these heroes.

But the Greeks were not the only people who thought that the elephant bones which were found buried in the earth were those of human beings. In Switzerland about three hundred and thirty years ago a violent storm uprooted an oak tree in the neighborhood of Lucerne. Sticking out from the big hole thus made in the ground were some enormous elephant bones. A professor in a college at Basel, after carefully examining them, said that they were the bones of a man, who in life stood nineteen feet high. Then he took the bones and put them together so that they looked something like the skeleton of a man. The people of Lucerne, believing from this that their ancestors were giants, thereafter used the figure of a giant as part of their city arms. And even to-day a picture of the skeleton made by

the Basel professor may be seen in one of the colleges at Lucerne.

In England, during the reign of Queen Elizabeth, much excitement was caused by the discovery at Walton of what was supposed to be the body of a giant. A man of the time, writing about this discovery, said that the giant's skull would hold five pecks and that every tooth weighed ten ounces! Then he added that it was plain to see these bones were those of a man and not of a beast. In America, mistakes just as queer were made. Cotton Mather and other well-known men considered the fossil elephant bones found throughout the United States proof that this country was once inhabited by a race of giants.

When elephant bones were first found in Siberia, the peasants supposed that gigantic animals were living far down in the earth. These animals, so said the peasants, were so strong that, as they traveled about beneath the ground, they dug out deep caves. But they could not live in the air and light of the upper world. Because of this belief, the peasants, when any elephant bones were discovered, thought

that they belonged to one of these animals which, in its wanderings, had lost its way and, coming to the surface of the earth, had died from breathing the air and seeing the light. The Chinese had a similar belief about the big bones found in their country.

Although the elephants began to be the rulers of the animal world long before any people lived, some of them were still on earth when man first appeared. These were the Mammoths. We know that this was so because Mammoth bones have been found in places where there are signs that man once made his home. In France a piece of fossil ivory has been discovered with the outline of a Mammoth sketched upon it. This drawing was the work of some one who lived long before people expressed themselves by the use of written words. For those first men and women and children had but little more intelligence than the animals which were their neighbors. They lived in caves and hunted these animals for their flesh and skins. And there were plenty of animals to hunt besides the Mammoth. For the bear, hyena, and ox, the bison and

horse, the fox and woolly rhinoceros, the Irish elk and the reindeer, were living then, and other animals, also. As the British Isles, Europe, and Africa were all connected at that time, these creatures had a wide range. The waters, too, were filled with animals, and through the rivers that crossed Europe hippopotamuses swam and waded from Africa to England, where many of them lived and died.

We may be sure that the flesh eaters among these animals hunted man even more than man hunted them. Then, also, the animals fought among themselves and men fought one another. So it was a time of continual warfare.

But, in the days when the Mammoths were the most powerful, there were no human beings living. It was probably more because of their numbers than of their size that these animals held dominion over all other animals for so long a period of time. It has often been said that both the Mammoths and the Mastodons were very much larger than any living elephants. This is a mistake. To be sure some of them were taller than are the elephants seen in exhibitions, for these are rarely more than nine feet

in height. But wild elephants over twelve feet tall have been captured. So far nothing has been discovered to prove that the Mammoth exceeded thirteen feet in height. When we remember, however, that a ceiling in a dwelling house is seldom more than ten feet high, an animal thirteen feet tall seems an enormous creature.

Many of the Mammoths were covered with hair, and these are known as the Hairy Mammoths. Next to the skin was a mass of soft brownish wool; then came a layer of fine hair, and outside of this was a coat of very coarse hair fully eighteen inches long. This hair kept the Mammoths warm when the climate was cold and also must have served as a protection against enemies. For surely when an animal tried to bite one of these Mammoths he found its hair very much in his way, and very much in his mouth; too.

The tusks of the Hairy Mammoth were wonderful and beautiful. Instead of being straight like the tusks of the living elephant, they curved outward and upward almost making a circle. They were like enormous hooks of ivory and sometimes thirteen feet long. What a mighty beast he was which

carried such magnificent ivory hooks on his head! And what a sight a whole herd of these creatures must have been when they made their way through the forests! Nothing could stop the progress of such a procession of Mammoths. They tramped down tall grasses and underbrush, leaving not a blade or a twig standing. When trees blocked their passage, they wound their great trunks about them and laid them low. When they came to the bank of a river, they forded it if it was shallow, and swam it if it was deep. As they climbed up the opposite bank some of them, no doubt, became mired and found it impossible to free themselves from the oozing mud. Imprisoned in this manner they died, sinking farther and farther into the earth until they entirely disappeared from sight. But the large majority of this traveling herd made their way up the bank in safety and journeyed on, leaving destruction in their pathway. And when they joined together and sent up a chorus of trumpetings, terrible was the sound thereof.

Such a scene as this must have occurred countless times throughout the world in the very places

where now are great cities in which an elephant is never seen except when on exhibition. And astonishing does it seem that once such herds traveled through the United States.

But it was not until after the Mammoths had lived for a long time in other countries that they came to America. They found their way here from Asia by crossing the strip of land that once connected that continent with Alaska. The Hairy Mammoth ranged from the Pacific to the Atlantic and about as far south as the Middle States. Another species, called the southern Mammoth, was in the meantime living in Mexico and in the states as far north as Washington city on the east and Washington state on the west. These southern Mammoths were even heavier and more awkward than the hairy species. Once in a while, some of them wandered up into the regions where the Hairy Mammoths lived, but they did not make those regions their real homes.

Yet, after all, the Mammoths were not the kings and queens among the elephants of America. For the Mastodons lived here in even larger numbers than did the Mammoths, and they excelled them in weight, in

(121) AMERICAN MASTODON

(From the painting by Gleason in the United States National Museum)

strength of muscle, and in length of body, but not in height. The chief difference, however, between these two species of elephants was in their teeth, for those of the Mammoth show a much closer relation to the true elephant than do those of the Mastodon.

It is thought by some scientists that the Mastodons were in America for a long time before the Mammoths appeared and that they lived here after the Mammoths had disappeared. Some even believe that early man in America saw the living Mastodons, but no positive proof of this has been found. But we do know that this country contained many other kinds of gigantic animals when the elephants were living here. Among these animals were bisons which measured ten feet between the horn tips; horses fully as big as any now in existence; water rats as large as bears; stags of amazing size; huge sloths and many other creatures now found only in warm countries. In those days all the countries in the world that are now cold had milder climates, although the vegetation was beginning to be much like that of the present time. There were dense forests all over America, and the grasses and bushes

grew so luxuriantly that they made good feeding grounds for all of the plant-eating animals.

The Mastodons thrived wonderfully on this diet; for, although they lived in all parts of the world, it was in America that they reached their greatest size and were the most numerous. They were scattered from one end of the continent to the other, and nowadays their bones are frequently found by farmers as they plow, and by laborers as they dig ditches or foundations for buildings. Often these bones are mistaken for logs. And then again they are so well preserved that whoever discovers them immediately knows he has brought part of a gigantic animal to light.

In Missouri, about twenty miles south of St. Louis, hundreds of Mastodons have been found together within a small space. Among them are great big ones which had probably lived to a good old age, little baby ones, and middle-sized ones. Michigan, Ohio, New York, New Jersey, Kentucky, and Florida have also yielded up remarkable skeletons of these creatures. But those discovered in New York are the best preserved, and the reason

for this may be that the animals died by being caught in mud, which quickly closed over them and served as an air-tight tomb. With one of these skeletons was found some long, soft, woolly hair; so it is thought that there may have been Hairy Mastodons, just as there were Hairy Mammoths.

None of the Mastodons have been recovered in as good a state of preservation as have some of the Mammoths that lived in a cold climate. For this reason we know more about the way the Mammoth looked than we do about the appearance of the Mastodon. In Siberia, Mammoths have been discovered with the skin and flesh still on them. The first of these discoveries was made in 1799 by a man who had gone to Lake Onkoul to hunt for fossil Mammoth tusks. One day he saw a huge, dark mass looming up out of the ice in the lake, but he paid no attention to the unusual sight. The next year he returned to the same place to hunt, and again saw the strange object in the ice out in the lake. Still he paid no attention to it. When he went back once more, three years later, the big mass had fallen from the ice and drifted

in toward the beach. Then he saw that it was a Mammoth. Yet all he did was to cut off the creature's tusks that he might sell them.

Two years after this, a man by the name of Adams saw this same Mammoth still lying on the beach. But by this time little was left of it except the skeleton. For the natives had fed the flesh to their dogs and what they had not used the wolves and bears had torn from the bones and devoured. The ground all round the skeleton was tramped down by these wild animals. Mr. Adams searched beneath their tracks until he found some of the Mammoth's skin and hair. He then took the skeleton and these fragments of skin and hair to St. Petersburg, a distance of 7330 miles. There the skeleton was mounted and placed in the museum of the St. Petersburg Academy, where it may still be seen.

In this same museum is another Mammoth, which was discovered as far north as the Arctic Circle. The position in which this animal was found showed that he had slipped into a deep crevice and had died while trying to make his way to safety. He had been eating grass just before he fell and when

unearthed thousands of years later, some of this grass was still in his mouth! During a hundred centuries or more he had stayed in exactly the position in which he died. This position showed that he had strained every muscle in his body in an attempt to work his way up over the edge of the crevice. But he had burst a blood vessel in the effort and that was the end of him. After his death, the earth and ice caved in on him, then froze. In this way the air was kept from his body so that it remained without change for thousands of years.

When this creature was alive, Siberia was probably covered with fir trees and hardy bushes. It could not have been as icy a country as it is to-day, for the elephants lived there in large numbers. Thousands of their fossilized tusks have been found, and many of them have been sold to manufacturers who have made them into ornaments or billiard balls. And those who use the ornaments or play with the billiard balls do not know that they are handling ivory that once was part of an elephant which lived in Siberia long before there were any people in the world.

But, after all, one of the most wonderful things

about the Mammoths and the Mastodons is that they finally disappeared completely. The elephants of to-day are, of course, their descendants, but none of them live in the countries where the Mammoths and the Mastodons were the most numerous. America, Europe, and the British Isles probably contained millions of these gigantic beasts. Yet they entirely disappeared and no one has yet been able to give a satisfactory reason for this disappearance. Some men think that the climate of the whole world suddenly became so cold that the elephants could not survive the change. Others believe that early man hunted both the Mammoths and the Mastodons until all were killed. But as Europe is the only place in which proofs have been found that early man and the Mammoth lived at the same time, and as no such proofs have been discovered in any country, regarding the Mastodon, there seems little reason for saying that these elephants became extinct because of man.

SOME SOUTH AMERICAN
RULERS
C.A.DAVIS '12

(130) *Restoration by Clement B. Davis*

GLYPTODON

SOME SOUTH AMERICAN RULERS

DURING the days when elephants were the monarchs of the world, there was a pool in Nevada where some of them and many other kinds of animals used to go to drink. At times the ground around the edge of this pool was so soft that the feet of the animals sank into it. Sometimes the footprints thus made in the mud were quickly covered up by other mud. Slowly, through the action of the water, all the mud around the pool was turned into stone. And while this stone was being formed the pool disappeared and so did the animals which drank from it.

At Carson City, Nevada, a prison is now standing where once was this pool. Some years ago it was discovered that the stones in the prison yard were dented with impressions of foot tracks. Many persons who looked at these tracks thought they had been made by gigantic men who wore moccasins. But now we know that these are the foot-

prints of animals which walked over that stone when it was soft mud around the edge of the little body of water that, long ago, occupied the site of the prison.

There are impressions in the rock which show that a deer walked down to that water's edge. In another place there is a path trodden by a Mammoth. In another are deep impressions where some creature sat down, perhaps to gnaw at a bone, and even the marks of the coarse hair on this animal's body are in the rock. Then there are footprints showing that two animals had a struggle on this very spot. One braced himself on his heels as if to resist the attack of the other which stood on his toes as he struck at his foe or tried to bite him. The peculiar shape of their footprints tells us that these two fighters belonged to one of the strongest families of animals that ever lived — the family of the sloths. The real home of the sloths was in South America, but some of them wandered into North America, and this was particularly true of the species called Mylodon. The footprints of the fighting animals at Carson City seem to have been made by My-

lodons, and when they visited that pool of water, they were far away from Patagonia, where most of the Mylodons then lived.

The only representative of the sloth family now in existence does not look much as though his ancestors were among the strongest of all the animals that ever made their homes on this earth. For the living sloth is a small, weak creature, unable to travel over the ground except by crawling along on the sides of his hands and feet. So he lives in trees and travels through them by hanging downward from the branches to which he clings with his claws. When he wants to sleep he rolls himself up until he looks like a ball, then suspends himself from a branch and there hangs, slumbering as comfortably as though in a nice, cosy nest. When hungry this creature is satisfied to eat the leaves nearest him, although others, softer and juicier, are but a little distance away. This is because he is too slothful to forage around for his food.

How different were his mighty ancestors! For they not only went far at times in search of a meal,

but, after finding it, often fought hard to keep other animals from snatching it away. And it is quite possible that those two sloths which fought by that pool in Nevada may have been quarreling over some appetizing morsel that both wanted.

But the most active food gatherer among all the sloths was the Megatherium — Powerful Beast. Indeed, this animal probably used more strength in securing his food than did any other animal in the world. When he felt hungry he started out in search of a tree for a meal. He went shambling along, as awkward a sight as one can well imagine; for his legs were short, his feet huge, and his body nearly as large as that of an elephant. Through the dense forest he made his way until he came to a tree which his instinct told him would be good to eat. Then he set to work. First he went all round the tree, throwing up the earth with his enormous front paws that ended in long, sharp claws. How the dirt must have been sent flying as the Megatherium proceeded with his task! When the ground about the roots was well loosened, this beast sat down, firmly planted on his haunches and broad

(135) *Restoration by Clement B. Davis*

MEGATHERIUMS GATHERING FOOD

tail. Grasping the trunk of the tree in his front paws he swayed back and forth, the tree swaying with him. There must have been a loud creaking of the trunk, an agitated rustling of the leaves, until down came the big tree with a crash. And there on the ground lay the Megatherium's breakfast, or dinner, or supper, as the case might be. Having worked so hard to get his meal, he probably enjoyed it all the more and gave the choicest bits, like the tender leaves and twigs at the top, many a caressing lick with his very long and very pointed tongue.

As thousands of Megatheriums once lived on the American continent many thousands of trees were laid low by them. It seems most strange that creatures possessed of such enormous strength should finally have ceased to exist. By looking at a Megatherium's skeleton a good idea of his strength is gained. For then one can see that this creature's thigh bone was nearly three times as large around as is the thigh bone of an elephant. The whole frame reveals muscles of extraordinary power, and the tail plainly indicates that it helped

bear the weight of the Megatherium when he sat down.

Some of these animals made their homes as far north as North Carolina, where their bones are found in old river beds. But for thousands of years after the gigantic sloths appeared in South America they were confined wholly to that country. This was because South America was for a long time an island. While it remained an island its gigantic animals ruled the country with little difficulty. But after a land connection was formed with North America and the northern animals began to make their way into South America, there was trouble for the sloths and other big creatures, for the northern animals were, as a rule, fiercer in disposition than were the southern species. The tremendous strength and long claws of the Megatherium undoubtedly made him a formidable foe even of the elephant. But, as he was much more awkward on his feet than the Ivory King, he surely met with defeat in many a battle which the two waged against each other.

All the sloths were covered with a very thick skin, on which grew coarse hair. And in addition

to this protection against the attacks of enemies the Mylodons were covered all over with small bones that were sunk deep into the skin. About the only creature then living in America which could bite through this skin was the saber-toothed cat. We are told that when one of these cats attacked a Mylodon, he jumped on its back and sank his teeth deeper and deeper into the sloth's neck until the arteries were severed. Then down would go the big Mylodon, a victim to a creature smaller but more vicious than itself.

But, although the Mylodons were not as good fighters as were the saber-toothed cats, they long outlived them. It has been proved beyond all question that the Mylodons were living after man appeared on this continent. In a cavern in Patagonia Mylodon bones have been found with the bones of men. And with these Mylodon skeletons were large pieces of skin covered with greenish brown hair. Some scientists believe that the Patagonian Indians kept the Mylodons in captivity, feeding them hay, and then killing them when they wanted to eat the flesh.

An interesting explanation is given by these scientists regarding the reason for the Mylodon living so long after the other gigantic animals of South America became extinct. This explanation tells us that all the southern part of South America was rather suddenly covered with water during the time of the sloths. The only animals in that part of the world which survived this flood were those that sought safety on some high section of land, and among them were a few Mylodons. The animals lived on the islands thus formed until the land under the water was reëlevated. And the cavern in which Mylodon bones have been found with the bones of human beings is supposed to have been on one of these islands of refuge. All this is only theory, but it seems a reasonable explanation regarding why some of the Mylodons lived so long after all the other gigantic sloths had entirely disappeared.

Even those strange creatures, the Glyptodons, became extinct while the Mylodons were still flourishing in many parts of South America. These animals belonged to the armadillo family and, like

the little living armadillos, were protected by a bony shield. Only, in the case of the Glyptodon this shield was of huge size. And resting on the top of his head was another shield that had the appearance of a flat hat.

Although this animal was as big as an ox, and often nine feet or more in length, his legs were so short that the shield over his back reached almost to the ground, completely hiding his body except the feet, the tail, and the head, which was carried very low down. The tail was made up of what have been called "movable rings," and the shield, when closely examined, proves beautiful in design, for all over it are rosette-like sculptures arranged in a set pattern.

The shield of the living armadillo is jointed so that the animal can roll himself up and be entirely covered with it as with an armor. The Glyptodon's shield had no such joints, but was constructed so solidly that it seems as though no animal which ever lived could have succeeded in injuring it. So the Glyptodon carried about with him wherever he went a valuable protection against enemies. But

it may be that the monkeys then living used to tease the Glyptodon by holding on to his tail and twisting it round and round in the same way that the monkeys of South America now plague the armadillo.

Glyptodon shields in almost perfect condition have been found imbedded in the ground in various sections of South America. One of them was put to a very practical use by a man who was obliged to live in the forests for a time, far away from the conveniences to which he had been accustomed. He found the shield near his shack. With the help of the natives he got it out of the ground. Then he built a little addition to his shack, placed the shield in it upside down and thereafter used it as a bathtub. And a very good tub it made, too, even if it was not porcelain-lined and nickel-plated.

The Glyptodons came up into North America, but they do not seem to have lived farther north than Florida. At that time in the world's history glaciers were drifting from north to south over portions of North America. When these glaciers began to move southward, the animals migrated in

the same direction to escape the extreme cold. It was after the ice had drifted north again that the sloths and other South American animals came into North America. Then once more the ice began to drift south, and many animals again journeyed into South America, where the climate was warmer. It took many thousands of years for all these changes in climate to occur, and when animals shifted their homes from South America to North America, they may have lived north for many hundreds of years before they felt the effects of the slowly approaching ice. After the last retreat of the ice northward, the Mastodon still lived on in the northeastern part of the United States. And about this time the horse, which, for thousands of years had been developing in this country, migrated to some other country, although just where he went we do not know. Nor were there ever any other horses in America until they were brought here by the Spaniards.

As the centuries rolled by, all the gigantic animals we have been learning about completely disappeared from the face of the earth, and man, at last, became

the ruler of the world. Just how long he has now ruled we do not know, but some scientists think that human beings have lived on this earth only about fifty thousand years. Before this the mammals were in power for three million years or more, and before them was the reign of the reptiles which lasted fully seven million years. And then, before the age of the reptiles, were other forms of life which can be traced back for so many millions of years that the mind cannot comprehend them.

As we have already seen, the reason this life can be traced so far back is because the fossil bones of many animals which lived in those days are found buried in rocks. And to-day other rocks are being formed all over the world through the action of water on mud and sand and shells, and the bones of creatures familiar to us are being changed into fossils within these rocks. Perhaps, millions of years from now, men, women, and children will gaze with astonishment upon these fossils, just as we now look in wonder and in awe upon the skeletons of the mighty animals which lived before man.

MIGHTY ANIMALS

How to pronounce their names

Arsinöe	är-sĭn′ō-ē
Allosaurus	al′lo-sō′rŭs
Arsinöitherium	är-sĭn′ō-ē-thē′rĭ-ŭm
Brontosaurus	brŏn′tō-sō′rŭs
Dinoceras	dī-nŏs′ēr-ăs
Dinosaur	dī′nō-sôr
Diplodocus	dĭp-lŏd′ō-kŭs
Elasmosaur	ē-lăs′mō-sôr
Elotherium	ēl′ō-thē′rĭ-ŭm
Glyptodon	glĭp′tō-dŏn
Ichthyosaur	ĭk′thĭ-ō-sôr′
Ichthyosaurus	ĭk′thĭ-ō-sō′rŭs
Mammoth	măm ŏth
Mastodon	măs′tō-dŏn
Megatherium	mĕg′á-thē′rĭ-ŭm
Morosaurus	mō′rō-sō′rŭs
Mosasaur	mō′sá-sôr
Mylodon	mī′lō-dŏn
Plesiosaur	plē′sĭ-ō-sôr′
Pterodactyl	tĕr′ō-dăk′tĭl
Stegosaurus	stĕg′ō-sō′rŭs
Titanothere	tī′tăn-ō-thēr
Titanotherium	tī′tăn-ō-thē′rĭ-ŭm
Triceratops	trī-sĕr′á-tŏps
Tyrannosaurus	tī-răn′ō-sō′rŭs
Uinta	ū-ĭn′tá
Uintatherium	ū-ĭn′tá-thē′rĭ-ŭm

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